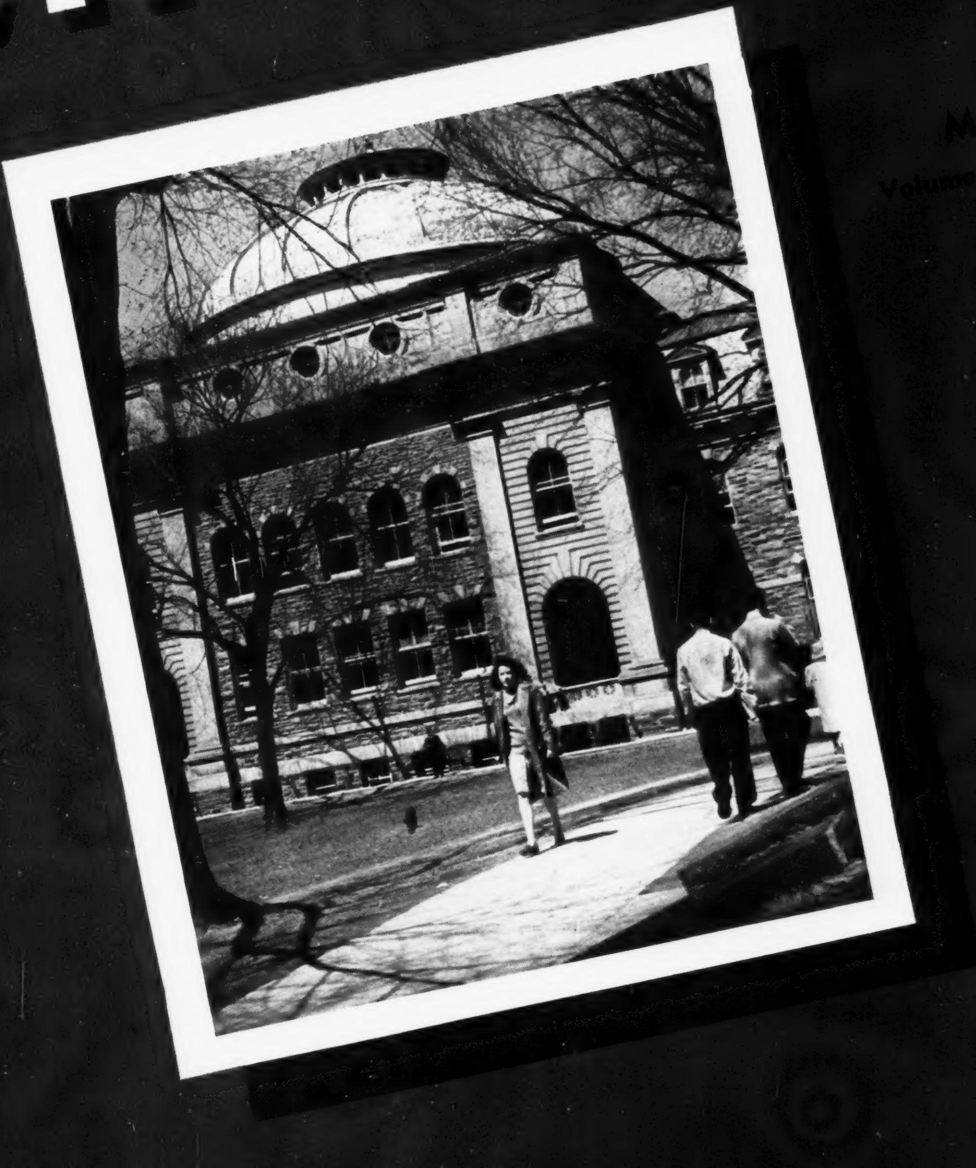
THE CORNELL ENGINEER



May, 1943
Volume 8 — Number 8

LLEGE OF ENGINEERING · CORNELL UNIVERSITY


Gas Holders
Coke Ovens
Processing Plants
Valves
Tar Roofing
Gas
Fast's Couplings
Time Cycle Controls
Gas Plants
Paints
Waterproofing
Coal
Road Tars
Coal Tar Chemicals
Piston Rings
Coke

Founded 1885

The CORNELL ENGINEER

Volume 8 — MAY, 1943 — Number 8

Contents

Editor for this issue: D. R. Lueder

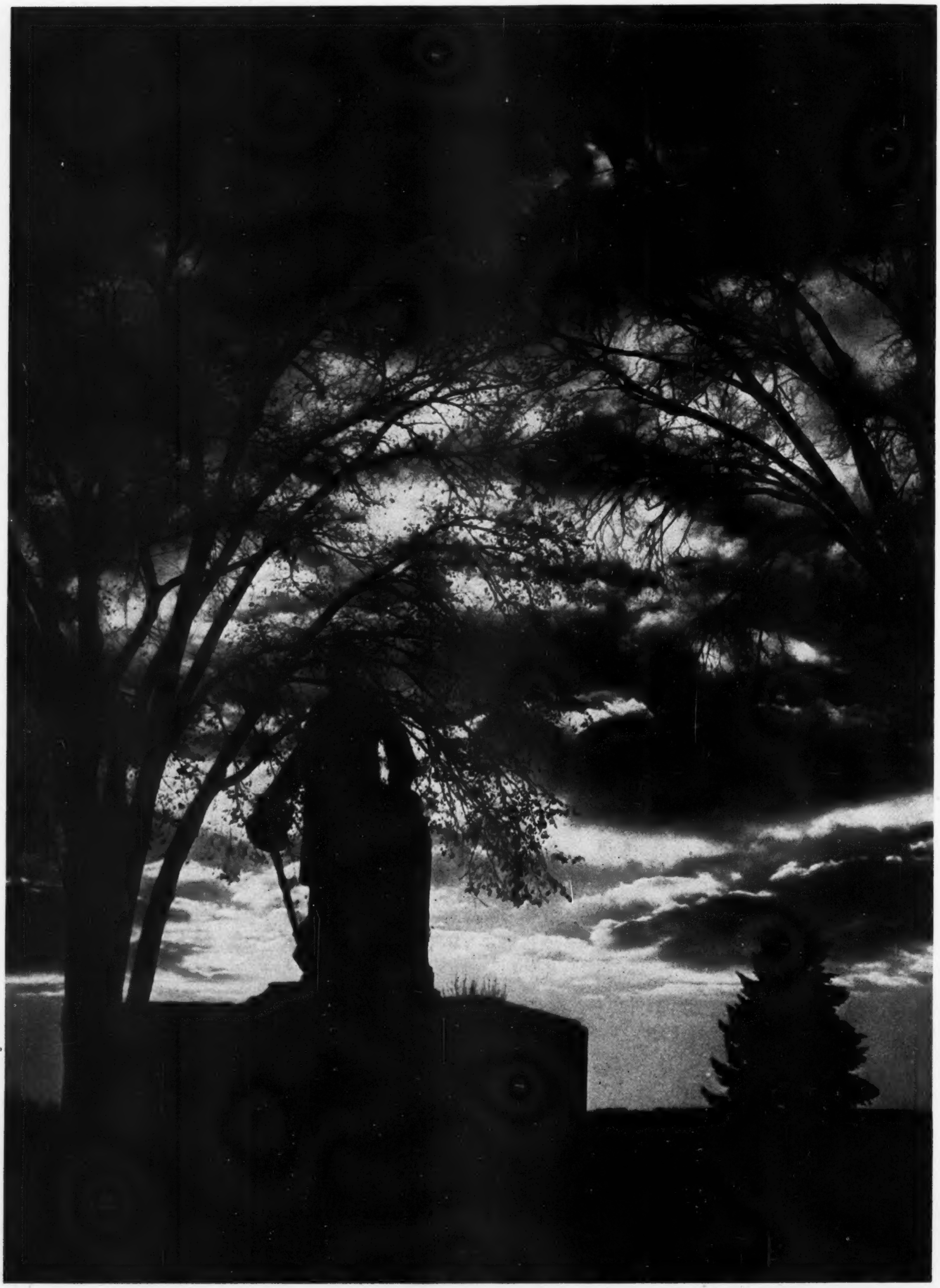
Members of The Engineering College Magazines Associated

Chairman: **Robert L. Taylor**
Chemical Industries, 522 Fifth Ave., New York, N. Y.

Arkansas Engineer
Colorado Engineer
Cooperative Engineer
Cornell Engineer
Drexel Technical Journal
Illinois Technograph
Iowa Engineer
Iowa Transit
Kansas Engineer
Kansas State Engineer
Marquette Engineer
Michigan Technic
Minnesota Techno-Log
Missouri Shamrock
Nebraska Blue Print
New York Univ. Quadrangle
North Dakota State Engineer
Ohio State Engineer
Oklahoma State Engineer
Oregon State Technical Record
Pennsylvania Triangle
Purdue Engineer
Rose Technic
Tech Engineering News
Univ. of North Dakota Engineer
Villanova Engineer
Wayne Engineer
Wisconsin Engineer

Published monthly—October to May—by the Cornell Engineer, Inc., Ithaca, N. Y. Edited by the undergraduates of the College of Engineering, Cornell University. Entered as second class matter at the Post Office at Ithaca, N. Y., under section 103, Act of October 3, 1917.

Subscription per year: regular \$1.50; with membership in the Cornell Society of Engineers \$2.00 (See President's page); student \$1.00; single copy \$.20.



"When the sun sets in the west . . ."

Progress In Plastics

By CHARLES A. NORRIS, M.E. '24

Technical Engineer, Bakelite Corporation

A LONG time ago someone made the statement that necessity is the mother of invention. This is undoubtedly the reason in no small degree for the advancement which has recently taken place in the art of plastic molding.

Not only have we witnessed the introduction of many new plastic materials, but the whole art of fabrication has gone through an evolution. Today, the molding of plastic materials compares favorably with the more highly organized methods of mass production in industry.

In recent years this evolution has taken place with such rapidity that it has been difficult even for those within the industry to keep pace with current developments. In order to appreciate more fully the progress that has been made, let us turn back the pages and first trace the development of molding materials.

Molding Materials

The first Bakelite thermosetting phenolic molding materials were introduced in 1909. These were of the cellulose-filled type, frequently termed all-purpose materials, as they were employed for a wide variety of applications. That was before the day of specialization.

As the uses of these phenolic materials expanded, it became desirable to have greater heat resistance. Thus, a mineral-filled, heat-resistant material was developed to meet this need. Then a modification of this mineral-filled material was produced for moisture and chemical resistance. This was followed by the development of the fabric-filled materials for applications where toughness and resistance to shock were important.

Shortly afterwards another mineral-filled material was produced that had superior electrical properties, particularly low-loss characteristics. Then came a number of other special materials, such as a high-resin content formulation to provide a higher surface luster and brilliance. Another development was resin molding board or blanks to be used alone for complete moldings, or for reinforcing of molded parts at strategic points where shock resistance is important. In addition to these there were also transparent phenolic molding materials developed for their colorful appearance, good chemical and water resistance properties, and fine electrical characteristics.

In 1928 came the introduction of ureas. These materials provided whites and ivories, and a wide range of light colored pastel effects which had exceptionally fine color stability or resistance to ultra-violet light. Recently melamine has been added to the ever-expanding list of plastic materials. While similar to urea in appearance, it offers greater moisture and heat resistance. Its electrical properties, particularly arc resistance, are excellent.

All these plastic materials, being either phenolic, urea, or melamine, are classed as the thermosetting or the heat-hardening types, because they become permanently "set" upon continued application of heat; Thermoplastic materials, on the other hand, can be repeatedly softened by heating.

About 1930, cellulose acetate, a thermoplastic material, was offered for sale. This material was extremely interesting because, in addition to being tough and resilient, it was also transparent, which made a wide range of beautiful color effects possible. Unlike the earlier cellulose nitrate it was not highly flammable. This is a real advantage. The introduction of cellulose acetate marked the beginning of a period in which great development took place in thermoplastic materials.

THE AUTHOR

SHORTLY after completing his studies at the Sibley College of Engineering, Charles A. Norris joined the Bakelite Corporation where he has become an authority in the field of plastics. At present, as Technical Representative of the company, he is concentrating on the application of plastics to our modern machines of war.

Mr. Norris is a member of the class of 1924. He hails from Boonton, N. J., and he will probably be remembered by some Cornellians for his accomplishments in the field of entertainment.

Charles A. Norris, '24

Polystyrene was made available commercially after the introduction of cellulose acetate. This is a material possessing such exceptional electrical properties that it is rivaled only by fused quartz or ceramics. Its chemical resistance is also exceptional, being one of the very few organic plastic materials known at present, that will withstand the action of the concentrated mineral acids, such as nitric, sulphuric, and hydrochloric acids.

The vinyl resins, particularly the vinyl chloride and vinyl chloride-acetate types, also possess exceptional resistance to water, oils, alcohols, and corrosive chemicals. First produced commercially in about 1933, these versatile plastics are now available both in rigid and flexible or elastomeric forms. The rigid vinyl plastics are colorful, tough, and have excellent dimensional stability. The elastomeric types are non-oxidizing, have superior electrical properties, are tough and abrasion-resistant, and, unlike rubber, can be made non-flammable. No vulcanization is required, and since they are thermoplastic, the elastic vinyl plastics can be molded by the rapid injection molding process.

The vinyl, methyl-methacrylate, cellulose aceto-butyrate, and ethyl cellulose have all made their appearance in quick succession, and there are still others in various stages of development. During the course of this material evolution, continuous improvements have been made in molding characteristics of thermosetting materials. For example, their time of polymerization, or "cure," as it is frequently termed in the molding industry, has been greatly reduced, thus speeding up the molding cycle. In the early days, the time required for polymerization was 15, 20, and even 30 minutes. Today it is from 15 seconds to 5 minutes, depending upon the size and design of the piece, and the type of thermosetting material used.

Fabrication

While this development of the molding materials was taking place, the art of fabrication was also passing through an evolution. At first, this was slow, and the improvements in the materials ran far ahead of molding practice, but recently molding technique has been catching up very fast. A review of the methods used in the past, as compared with the present, will indicate the progress that has been made.

The first molded parts made of Bakelite phenolic materials were produced in molds that had been built and were being used for the production of hard rubber articles. This came about in a very natural way because, after all, the initial interest shown in these new and unique substances came from users of hard rubber parts for electrical insulation. As a result, the molding practice used for hard rubber was applied to the fabrication of these new molding materials.

Hand molds were used. These tools were loaded with the required amount of materials. They were assembled on the molder's bench, and then manually placed in a comparatively small hydraulic press for the application of heat and pressure. In many instances, the hydraulic pressure was also built up on the press by means of a hand pump. They were removed from the press and knocked apart on the bench. The entire operation was manual. This method of molding was, of course, very slow. Multiple cavity molds were used in order to increase production, but they were still hand molds. As more molders entered the field and competition became keener, the need for higher production rates and lower costs became more acute.

Semi-automatic Press

To meet this need, the so-called semi-automatic press was developed. This took place about 1915 and was the first real advancement to take place in the art of plastic molding. In the semi-automatic setup the upper and lower portions of the mold are rigidly fastened to the top and bottom parts of the press, thus eliminating the necessity for the operator to handle the mold manually. The semi-automatic press made possible the use of large, multiple cavity molds. Tools grew in size, and now molds containing 150 and 200 cavities are common. These large molds require more powerful presses for their operation, and so press capacity also increased.

In addition to the conventional semi-automatic press that operates on the straight up-and-down principle, modifications made their appearance, such as the tilting head press and the double station unit. While these types met with some degree of success, they were never

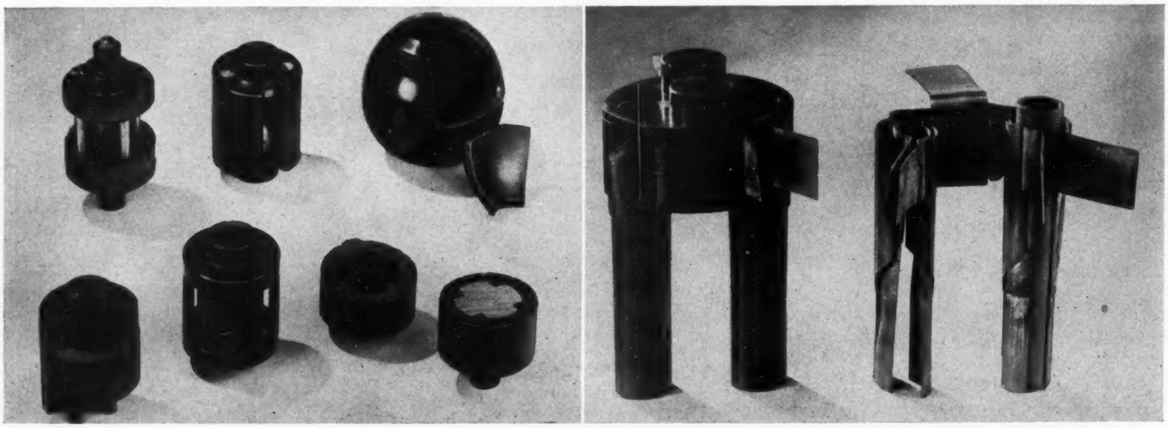


Figure 1. Ingeniously moulded plastic articles described in the text.

universally adopted.

The introduction of large multiple cavity molds made hand loading of loose powder impractical. This stimulated the use of preforms, or tablets, made by cold pressing a measured amount of molding materials. At the beginning these preforming machines turned out about 50 to 60 tablets per minute, but now their speed has been stepped up so that rates of 600 to 700 preforms can be turned out per minute.

For some time the plastics industry went along without any other important changes taking place in molding technique. Then, something happened. In the early part of 1926, the Shaw Insulator Company at Irvington, N. J., were attempting to mold firing pins for the U. S. Navy. This piece consisted of a steel insert about 1¼ inches long that was to be encased in a shell of phenolic molding material. Then, as now, the dimensions were rather "fussy."

Compression Molding

Attempts were made to produce this part by compression molding. The insert was not placed horizontally in the mold because the high and unbalanced pressure exerted upon it in that position might cause distortion. Also, the use of a split mold would undoubtedly cause the parts to be out of round. The extent of the eccentricity is measured by the thickness of the flash. In order to overcome these difficulties, the insert was placed in a vertical position. While the elimination of a split mold took care of eccentricity, it did not overcome the distortion of the insert.

It was then that the idea was conceived of placing the insert in the mold and closing the mold empty, and then, to use Mr. Shaw's own expression, "transfer" the molding material in a plastic state into the cavities through openings or gates from an auxiliary pressure pot, located above the mold proper. Thus, transfer molding was born. This took place in the early part of 1926; the date is not only interesting, but also significant, particularly when it is remembered that thermoplastic materials and injection-molding machines were not in general use prior to 1930.

The results obtained on the firing pin job through the use of transfer molding were so encouraging that it was decided to try this method of fabrication on another part, this time for a different reason. A long narrow piece was being produced for one of the business machine companies. It carried on both its face and back a series of graduations together with numerical figures. These were formed as depressions in the molded piece, which were filled in with white paint to make them readily legible. The corresponding raised sections of the mold were continually being damaged and "washed off" by the action of the molding material when the parts were produced by compression molding. Mold repair costs ran

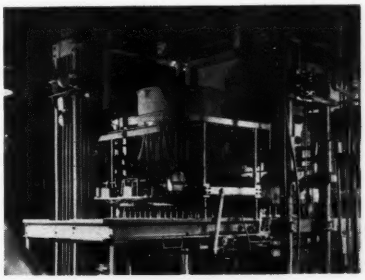


Figure 2. Automatic rotary molding press.

high, and in order to overcome this condition it was decided to convert this mold from a compression to a transfer type.

The results were very gratifying. The successful outcome of these two jobs lead to a third—fountain pen barrels, heretofore a stubborn problem which challenged the ingenuity of the young but ambitious plastic industry. Most of the molders in these early days had at one time or another attempted to mold fountain pen barrels with varying degrees of success. All the tricks known at the time on compression molding were tried, but still the comparatively long and slender core pins would bend with the resulting non-uniformity of wall thickness.

By the transfer method of molding, high and unbalanced initial pressures were minimized because the material was brought to a soft plastic state before entering the mold cavity. Thus, core pin distortion was no longer a major problem.

Experience gained here was readily adapted to the molding of pencils which were turned out by the millions. These pencils are of the propel and repel type in which the lead may be advanced or retracted at will be means of a helical thread running the entire length of the barrel. They were produced in a multiple cavity mold using two rectangular pressure pots. This arrangement was chosen in order to obtain equal distribution of material over the entire length of the mold, and at the same time provide ample pressure chamber area.

Mold Design

In the design of transfer molds, it is of fundamental importance to keep the area of the pressure chamber at least 15 to 20 per cent greater than the projected area of the cavities. Thus the pressure exerted on the mold, tending to keep it closed, is at all times greater than that developed within the cavities trying to push the mold open.

In order to investigate further the possibilities of transfer molding, a number of experimental molds were built. They consisted of cylindrical shaped objects approximately 1¾ inches in diameter with an overall length of about 1¾ inches. They are hollow with closed ends, except for a hole about ⅜ of an inch in diameter. Their features include:

1. a glass rib projecting into the hollow inside portion, but not coming through the outside wall.

2. a lining of thin copper foil about .003 in. thick, molded on the inside wall of the hollow cylinder. This has now become rather badly torn due to skeptical investigators picking at it. They found it hard to believe their own eyes.

3. threaded inserts incorporated so as to project into the hollow cavity, but extend through the sides of the piece.

Figure 1 illustrates some of these parts. The piece in the upper left-hand corner has a one piece floating ring, molded in place, yet free to slide up and down on four vertical steel pins. These, too, were molded into place as inserts.

(*Continued on page 22*)

Wartime Engineering In A Small Factory

By JOHN W. HOLT, M.E. '08

IN February, 1942, Ben Forker, M.E. '29, had his business in materials handling equipment marking time due to the uncertain outlook brought on by the war. He camped out at the Army's Wright Field in Dayton, Ohio, until he obtained a contract for several hundred portable engine hoists, used for removing plane engines in the field.

One Saturday Ben called up to find out if I would take over his engineering work the following Monday. Before the week was out I found myself working on engine hoists. Since then our all-out production effort has meant one adventure after another.

The shop of the Forker Corporation was in Cleveland, Ohio. At that time, in addition to Ben and myself, our organization consisted of a young man slated to become shop superintendent, an ex-navy man with excellent drafting room experience, and a stenographer. On call were a punch and shear operator, a couple of welders, and one or two factory hands. The shop was all on the ground floor with the offices, drawing room, etc., on the second. The factory floor space was around one hundred and seventy feet long by sixty wide, with a fourteen foot overhead clearance. The equipment included three arc welding units, hand gas welding and cutting torches, a small engine lathe, a couple of drill presses, a forty ton hydraulic press, a combination punch and shear, and a two-ton crane that handled the steel into storage.

The Hoist

We were told that the engine hoist was the brain child of a couple of mechanics in the ground crew of a Texas air field. From there it was sent to Wright Field and a design worked up from which a number were built prior to the contract awarded to the Forker Corporation.

The structure consists of two main elements, a boom in the form of an elogated diamond, and a frame in the shape of a letter A (see illustration). The boom and the frame intersect at the center of the boom. They are made of steel tubing which is also used for the centerbrace at their intersection, the rungs in the boom, and the spreader tube at the lower end of the frame.

THE outbreak of this war found Mr. Holt retired from active production. He had been dividing his time between a New England farm and some patent work in Cleveland. Now the war has him back in industry, in charge of engineering for the Forker Corporation.

While at Cornell, Mr. Holt was active in many fields including Crew and Sphinx Head. Since his graduation in 1908 he has been employed at various jobs in industrial engineering, mostly in the automotive field and especially in welded tube manufacture. Among the firms he has worked for are Standard Welding Co., Parker Wheel Co., and Steel Tubes Corp. Since 1931 Mr. Holt had been on his own. He took up patent work, since he found quite a bit of patent litigation in the automotive field, when he was associated with it.

Originally, steel cables served as tension members connecting the top of the boom to the top of the frame and the top of the frame to the bottom of the boom. From this last point there were similar connections to the lower frame legs, which in turn were tied to each other.

The cable between the frame legs was supplemented by the spreader tube mentioned above. This apparently had been added after it was found that the legs tended to spring together when the hoist was moved under load. In our design we made the spreader tube adjustable as to length so that it might be used in either its regular position or in place of the cable, and omitted the latter altogether.

Wheels were mounted on the lower ends of the frame and boom. The one on the boom was carried upon a king pin so that it could be swiveled while maneuvering the hoist into place. Extensions to the wheel axle on the boom provided a means of attaching a towing handle to the hoist.

The various tubular parts were connected at their intersections by bolts or pins, either directly or through the use of gusset plates and lugs welded to the tube. A similar system of pins and anchor plates were used for connecting the cables. This made it possible to completely dis-assemble the unit for packing or moving from field to field by plane.

At the time I arrived upon the scene, Ben's estimate, which included proposed methods of production, had to serve as a guide in re-arranging and equipping the shop. Like the design of the hoist, it was subject to modification from time to time.

From then on, all we had to do was to get out working drawings of the eighty odd parts and their sub assemblies that went into the hoist, design or improvise jigs and fixtures, order materials, look up subcontractors, locate additional equipment, rearrange the shop, including raising a portion of the roof in the form of a monitor, to give us clearance for the final assembly and load testing, install fluorescent lighting, cleaning tanks, spray-painting booths, and the like. Last came the matter of designing suitable crating for domestic and export shipments, an engineering job in itself.

In addition, Ben had the problem of arranging for the financing, as the dollar value of the contract was much too large to be carried on the financial structure of the company.

There were also various rules and regulations concerning priorities that entered into the picture. At the time they were being changed about once daily. In placing orders for supplies, I got all tangled up in them and was urged to cease. It would seem that I was of more value to the company as an engineer than I would have been as its representative on a government rock pile, the announced reward for using the right priority at the wrong time.

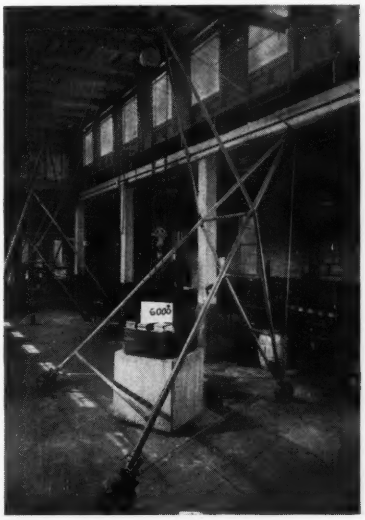
Before we were through we had added to our equipment a second hand heavy duty lathe, a small and a medium sized turret lathe, four more arc welders, a flame cutter, a steel cutting band saw, two moderate sized and one small drill press and a light hand operated crane in the monitor. With these additions we estimated that our production would average from ten to fifteen hoists per day.

The original specifications called for rubber tired wheels and chrome-molybdenum tubing and parts, where welded together. The use of rubber was out before we started. The alloy could still be obtained if you waited long enough. We waited about three months. In a way, it was our salvation as we gained that much more time in which to rearrange and equip the shop.

Recruits From Cornell

In the meantime there was the need of building up our manpower. For several years both Ben and I had taken boys to Ithaca for Cornell Day. This time Ben said that he could not make it but that I should and at the same time see if there were any seniors in engineering that were looking for a start in a new war industry. In addition I was to look up any undergraduates that might be available for a summer job.

Arriving in Ithaca, I found that every senior in the class who was not scheduled for the army or navy, was already placed, having had the choice of around a dozen offers. I then went to work on the undergraduates and eventually signed up Jack Baer, Harold Sipperly, Clyde Loughridge, Jack Thompson and Jack Barker. The last named was an Arts student.



Hoist under load test

Before the summer was over we almost made an engineer out of him. We also took on three high school boys including Jack Thompson's brother Paul.

Since they were all to be on an hourly rate, they were naturally interested in the number of hours per week they were to work. We promised them at least forty eight. As I recall, there were times when the digits were reversed to eighty four. The number was rarely less than sixty, once the raw stock for production began to arrive.

In working up the shop drawings from the Air Corps design, it was found that the angles shown on their drawings did not always check up with some of their dimensions. Our ex-navy man, who had been made chief draftsman, must have decided that here was a chance to start something with another branch of the service. He insisted that the errors be corrected. Starting with certain of the angles and dimensions that were in agreement, he worked out a basic dimension diagram for the boom, frame, and their assembly, which is a masterpiece in computing triangles.

Right there I made a much more serious error than the Air Corps. I agreed to act as checker for his calculations. They were carried out to the fourth decimal place. Even now I doubt if the Air Corps engineers believe that our layout is right, but so far they have never proved that we were wrong. This all went on while we were waiting for the alloy steel tubing.

To help settle the argument on the dimensions it was suggested that we make up a pilot model from ordinary warehouse steel tubing, using the angles and dimensions that we had worked out. This was done. After checking the assembly it was sent to Dayton. While there it was placed under load test to see what might come of it.

As the maximum required load was approached, a serious deflection developed in the boom, due to the stretch in the steel cable. Ben, who was in Dayton at the time, had some solid steel tie rods made up and substituted for the cable. It was then found that our sample made of mild steel tubing had the required capacity. As the alloy tubing was about ready for delivery, it was used on the first order. Since then, ordinary steel tubing has been accepted in its place.

Tie rods in place of cable were substituted at once, as well as several modifications in the methods of connecting the boom and frame members. These last had been included in our model to simplify manufacture, reduce the number of sizes of bar steel required, or stiffen up the assembled structure under swing load. Thanks to the good showing made in various tests, we were allowed to make these changes even when it meant a departure from the rule that all parts must

(*Continued on page* 30)

Photographic Film Manufacture

By GERALD R. SCHILLER, ChemE '45

THE production of photographic sensitive materials is a highly specialized industry employing some 20,000 persons throughout the world. When the dry gelatine plate was introduced (formerly the wet plate was used), photographers ceased preparing their own materials and used the ready-prepared plates. The first dry plates appeared on the English market in 1877. By 1880, the manufacture of dry plates was general in England and was starting in many other countries, including the United States. Until the turn of the century, the photographic industry was usually carried out in small factories under supervision of the founder. Today, however, this manufacture is carried out on a large scale using specially designed machinery at every step. In the largest of these factories the output of motion-picture film alone exceeds 150,000 miles a year. Over 5,000,000 lb. of cotton are used each year for the manufacture of film, and over three tons of pure silver bullion are used each week. The total power required exceeds 20,000 h.p., while the consumption of coal is over 500 tons per day. The process of manufacture may be divided into three separate sections, the preparation of the base, the preparation of the emulsion, the coating of the emulsion on the base and the cutting and packing of the material.

The Base

There are two types of bases used, the glass plate and the film base. For the glass plate base, specially selected best quality thin glass, made in a special factory, is used. The glass plate is cleaned by an automatic machine which scrubs it with a strong solution of caustic soda. When the cleaning is complete, the plates are covered with a thin layer of gelatine containing chrome alum. This coating is known as substratum. The plates are allowed to dry in an oven, and transferred to the coating room. The substratum causes the emulsion to adhere to the glass. In the production of the film base, the first step is the preparation of the cotton linters for acetylization, the treatment consisting of cleansing the linters very thoroughly and drying them. The linters are put in tanks which contain a mixture of sulfuric acid, acetic acid and acetic anhydride. A vigorous reaction follows. When the process is complete and the acetyl content is 44.8%, the reaction mixture is poured into water. A soft, opaque precipitate results. This is cellulose triacetate. Since the triacetate does not have the proper solubility or properties for industrial use it must be hydrolyzed. Hydrolysis is the reaction of a substance with water in the presence of a catalyst. This is hydrolyzed in the presence of sulfuric acid until an acetyl content of 37-41%, suitable for use as an emulsion, is obtained. Upon completion of the process, the cellulose acetate is washed with water until acid-free, then with alcohol to rid it of water.

The dry cellulose acetate is placed in tumbling barrels or mixers with a suitable solvent, usually acetone and methyl alcohol, and the so-called softener, camphor. When thoroughly mixed, the product, called dope, appears as a viscous mass somewhat like honey. The dope is now spread out in a thin film by coating on wheels about 4 feet across and about 15 feet in diameter. These wheels rotate slowly about their axes so that by the time one rotation is completed the solvents have evaporated sufficiently to set the film, which is stripped off the wheel and dried further by passing over drums. The operation being continuous, the film base is prepared in rolls of about 2000 feet. The film has a high polish on both surfaces and may be used at once, stored, or seasoned until required. Before coaating with the light-sensitive emulsion, one side of the film is treated with a substratum, which in effect is an etching solution that roughens the surface to aid in holding on the emulsion. For roll film, the back is coated with a non-curling coat of hardened gelatine, which, imposing as expansion strain on this side, equalizes that of the emulsion on the other side. The thickness of the film base varies from .00325 inch in roll film, to .010 inch in certain cut films.

The Emulsion

Emulsions are of two general types: washed and unwashed. Those to be coated upon glass or film are always washed. The emulsion is one of precipitated silver salts in gelatine, and is made in the following manner. The precipitation of the silver salts is effected by adding a 10% solution of silver nitrate to a small quantity of gelatine dissolved in a solution of halide salts, which is usually potassium bromide containing a small amount of potassium iodide. When the precipitation is complete, the emulsion is digested, that is, held at an increased temperature for a period of time. This increases its sensitiveness to light. The bulk of the gelatine is then added and the mixture is allowed to cool so that a jelly will be formed upon setting. The set emulsion is cut up into small pieces and washed in running water in order to remove any excess of halide salts and also to remove the soluble nitrate produced in the reaction. After washing, it is given a final digestion and is ready for coating upon the base.

Coating And Packing

The glass plates are coated by passing the prepared plates on a travelling belt which passes under some device through which the emulsion is allowed to spread over the surface of the glass. The coated glass travels forward on to a belt or rollers which are kept wet with ice-cold water, and there the

emulsion sets. At the other end of the machine the plates are taken off, placed on racks, and dried slowly and evenly. They are cut to the correct sizes by machines using diamonds.

For coating roll film, the stock roll of the base is carried on a freely revolving mandrel, and is led over rollers that keep it taut to the coating trough into which the fluid emulsion is fed continuously and automatically at the rate which the film base takes it up. The base passes under a roller, dipped into the emulsion. It hugs this roller so tightly that no emulsion finds its way on to the back of the film. The temperature and viscosity of the emulsion are kept constant, and the thickness of the coat is determined by the rate of travel of the base through the emulsion—the faster the travel, the thinner the coat. The coated base is passed up a vertical run-up which allows the film of emulsion to even itself out. It then passes over a chill roll and finally through a refrigerating chamber, where cold air is blown on the emulsion surface thoroughly setting it. Leaving this chamber, the film is automatically looped into festoons varying from 5 to 20 feet in length and travels slowly through the drying tunnels. These tunnels are supplied with heated air which has been thoroughly washed with water sprays to remove dust and gases. The humidity and temperature of the air used for drying is adjusted very carefully. The air is usually recirculated through the system, being driven in at one end of the drying room, exhausted at the other, and then reconditioned before being used again. The operations of coating, drying and reeling are automatic and continuous.

The camera or cartridge film is slit to the required widths, cut to the desired lengths, and spooled on metal cores with light-excluding flanges. A light protecting apron of black paper is wound with the film so that the cartridge may be inserted in the camera in daylight.

Film leaving the coating machine *Courtesy Agfa Ansco Co.*

Motion picture film is slit from the original roll to the exact width required (35mm. or 1⅜ in. in the case of standard film). Before packing it is perforated on the edges in accordance with standard guage used for cameras and projection machines. The makers name and private mark are light impressed on the margins, becoming visible only on development, while on the negative film every foot is numbered in order to aid in the identification of scenes. Negative film is not only coated with ordinary emulsion, but also panchromatized, which gives better rendering of all colors and permits considerable shortening of exposures, especially under artifical illumination. For amateur motion picture photography, the film is supplied on the safety acetate base in 100 foot lengths packed with paper leaders on the ends in a special protective reel to facilitate daylight loading. This film is made so that upon development, the image reverses from a negative to a positive one in order that the same film may be used in the projector. Thus, a positive copy does not have to be made from the negative as is done in professional work.

The manufacture of light sensitive materials has grown from the tiny one room laboratories of Daguerre and Niepce in the early 19th century through the small, crude factories founded in the latter part of the century to the huge, efficient factories of today where scientific control and uniform production is the keynote.

NAVY COLLEGE TRAINING PROGRAM

> The information on this page is taken from an article by Lieutenant Raymond F. Howes, A.B. '24, U.S.N.R., which appeared in the April 15, 1943, issue of the **Cornell Alumni News.**

THE new Navy College Training Program, which will go into operation in nearly 200 American colleges and universities on or about July 1, is designed to train officers for the Naval Reserve, the Marine Corps, and the Coast Guard in the required numbers and with the necessary types of education to meet the needs of the Navy. Established colleges and universities are being used for this program not because the Navy has accepted any responsibility for insuring their solvency, but because the Navy is confident that they have facilities for instruction and staffs of teachers better fitted than any others for the task that must be done. The Navy must have a continuous supply of thoroughly trained officers if it is to play its full part in winning the war. It is asking a selected group of colleges and universities to help train them.

To Follow College Pattern

In making plans for the new Navy College Training Program, the Navy Department relied heavily on the experience and judgment of college professors and administrators. It has agreed that the new program should go into effect with the least possible disruption of the academic careers of college students already enlisted in the U.S. Naval Reserve and the Marine Corps Reserve. Whenever possible, students will be permitted to complete their training in the institutions they now attend; and they will not be taken out of college for a period of military training before resuming their college work. Intensive military training will come later, in schools especially designed for that purpose.

The Navy Department and its civilian advisers have also agreed that the trimester plan, with three sixteen-week terms in each calendar year, will be most effective, since it closely approximates the schedule of accelerated programs now in effect in a majority of colleges and universities.

This matter of admission is important, because the Navy hopes that most of the colleges selected to train its students will enroll them in the regular way and give them all the privileges, including earned academic credit, enjoyed by civilian students. Assignment of students to specific colleges will be done by the Navy, but every effort will be made to honor Navy students' preferences. Furthermore, students under seventeen years of age who enter colleges having Navy units and enlist while undergraduates will, whenever possible, be permitted to continue their studies where they are. If they take the prescribed Navy courses in their early terms, they will have the opportunity of entering the Navy College Training Program with advanced standing.

Within the limits set by the objectives of the program, the Navy desires to preserve the normal pattern of college life. Navy students will be permitted to join fraternities, to accept election to the boards of college publications, to become members of musical clubs and dramatic organizations, to take part in athletics; in short, to receive all the benefits that can be derived from activities not centered in the classroom. The only restriction is that such participation shall not interfere with the Navy student's success in his studies or with his duties as an enlisted man in the Navy.

A large share of responsibility for the successful operation of this program has been placed squarely on the shoulders of college administrations and faculties. They must see to it that competent instruction is provided and that high academic standards are maintained. The Navy also expects them to make the usual provision for academic records, library service, student counseling, organized sports, and appropriate special lectures and other campus events.

By terms of the contracts offered by the Navy, the selected colleges and universities also agree to supply acceptable medical service, housing, and messing facilities to Navy students. Some reorganization of housing and feeding will be necessary on most campuses, because rooms and food (as well as uniforms and payments of $50 a month) are to be provided at the expense of the Navy. Housing units, especially, must be satisfactory in respect to living accommodations, conveniently located, and sufficiently large to allow supervision with a minimum of Navy personnel, because the Navy must conserve its present supply of trained officers and men. Most of the colleges that have been offered Navy contracts understand this problem and have designated their best housing units, including numerous women's dormitories, for use by Navy students.

Officers To Be Assigned

The Navy will assign to each college training unit a commanding officer, who will have appropriate assistance from commissioned and enlisted Navy personnel. He will be responsible for discipline, for instruction in Navy organization and customs, and for supervision of required physical training. He will also cooperate with the college administration and faculty in mantaining proper standards of housing, messing medical service, and instruction; but in general, the military phases of the program will be definitely subordinated to academic work.

There is only one basic justification for the Navy College Training Program. The Navy needs officers in far greater numbers than ever before. Such men must be discovered wherever they are—in college, in secondary schools, among enlisted men—and properly trained, in the shortest possible time, for military duties that will use their special abilities to the greatest advantage.

Saved! Tons of tin!

For years telephone cables have been spliced in a very satisfactory way. But the solder joint contained 40 per cent war-vital tin.

So Bell System men devised a new type of joint which saves up to 80 per cent of the solder. A "Victory Joint" they called it.

The new technique has been adopted throughout the System with the result that 600,000 pounds of tin and an even greater amount of lead can be saved in a normal year's construction.

This is another example of the nation-wide cooperation of Bell System people in fulfilling their ideal —service to the nation in peace or war.

NEWS OF THE COLLEGE

Tau Beta Pi Elects

In addition to the Tau Beta Pi elections reported in our last issue, the following have since been elected to this honorary engineering society:

Commander Robert Edward Bassler, U.S.N.
George W. Bishop, ME '44
Professor J. N. Goodier
Mr. Alfred Marchev

Tau Beti Pi has elected the following new officers: president, John A. Newman, ChE.; vice-president, James A. Purdy, AEME; recording secretary, John E. Westberg, ChE; corresponding secretary, Robert S. Rochlin, EE; and treasurer, John T. Parrett, ME.

Radio Training Course

Continuing its program of war training courses, the University began a course in the fundamentals of radio on March 3rd. The course was open to qualified men and women in the Ithaca area who were interested in that type of work. The course, which holds its classes three nights a week, is held in the rooms of the College of Engineering.

The course is part of the Engineering, Science, and Management War Training program which is sponsored jointly by the U. S. Office of Education and Cornell University. The present course supplements other courses of a similar nature which have been and are now being given. The program is fortunate in having available for its use the modern lecture, laboratory, and class rooms of the newly completed Olin Hall of Chemical Engineering.

The principal effort of this course is to interest men and women who can put the training in radio communication to good use in essential industry. Others, according to Prof. Walter L. Conwell, particularly young men training for military service, may find the course of great value.

War Courses

In addition to Army and Navy engineering courses, Cornell University has been approved by the War Manpower Commission for use by the Army and Navy in five other basic and specialized training projects.

While approval makes an institution eligible to participate, it does not guarantee use of the school.

The University now stands approved for "possible contract" by the Navy Department for basic training on the new, navy college program, V-12; for basic training in the army specialized program; army personnel psychology program; army language training program, and pre-medical training.

Diesel Power Boat

Capt. B. W. Chippendale, commanding officer of the Naval Training School, has announced that a seventy-two foot power boat has been assigned here for use as a "laboratory afloat". The converted yacht, powered by two Diesel engines, is at present being used by the student officers for the study of engine room layout and operation. As soon as ice clears from the channel, however, trips will be made on the lake. In charge of the boat is Ensign R. F. Brooks. In charge of the instruction is John C. Gibb, M.E. '24.

Steam Engineering

Early last January the Naval Training School here at Cornell opened a new course in steam engineering for the United States Naval Reserve Officers. The course started with nine men, but twenty-five will be added monthly.

The purpose of the course is to train naval officers for specialized duties in steam engineering with our naval forces. The course deals with steam turbines, boilers, pumps and auxiliary equipment, as well as with the electrical equipment that goes with it.

Eta Kappa Nu Elects

Eta Kappa Nu, honorary electrical engineering society, has elected the following new members:

Juniors
Jose del Palacio
Moody Chalmers Thompson
Howard Glenn Turner
Accelerated Sophomores
Charles Gale Mallery
Robert Bashford Trousdale
Harrison Carlton Whitman

At the initiation banquet held April 29, the following new officers were elected: president, Milton Stolaroff; vice-president, Robert H. Garmezy; treasurer, Joseph C. Logue; corresponding secretary, Anthony J. Prasil; and recording secretary, Moody C. Thompson.

Diesel Instructors

A new course for training of instructors in Diesel Engineering, said to be the only one in the country started at Cornell on April 5. It is part of the Naval Training School program. Initial classes comprise 25 officers, all with previous experience in Diesel Engineering.

The course, which will emphasize teaching methods, analysis, and presentation of subject matter, will be based primarily on the type of instruction being given here in Diesel Engineering.

Designed to meet a shortage of teachers in this field, the new program, to be administered by Dean S. C. Hollister of the College of Engineering, also will include instruction by staff members of other colleges.

Students will receive one month of specific instruction in connection with the Diesel school here, to be followed by actual teaching in a classroom for one or two months or until reassigned elsewhere to Diesel engineering schools.

While engaged in practice teaching here, they will have the benefit of criticisms from the educational staff on methods, presentation, organization, delivery, and general effectiveness.

Marchev Speaks

"A great deal has taken place since I was in Ithaca 30 years ago, in the days of the 'flying kites', working for the Thomas Morse Aircraft Company," declared Alfred Marchev, vice president and general manager of the Republic Aircraft Corporation in a talk presented several weeks ago to Cornell's engineering seniors.

He then proceeded to tell them of developments in the aviation industry, particularly of Republic's P-47, known as the "Thunderbolt". A model of the fighter plane was on display.

Back in 1929-31, he said, the noted Russian designer, Major de Seversky, tried to arouse some interest in designs for fighter planes, but had to turn to racing planes because of public and official apathy. Little was heard about this industry until around 1935. A corporation was formed which was not very successful financially, and out of the reorganization came the Republic concern of today, the speaker pointed out.

He said the forerunner of the P-47 came from a sketch and some figuring done on a back of an envelope by one of the company's engineers during a conference.

Pointing out that everything in the making of a plane is mathematically calculated, Mr. Marchev said that 20,000 fabricated metal pieces are used in the construction, and that people who never before saw the inside of a plant, former buttonhole makers for example, are turning out machines.

Citing difficulties of the early days, the speaker said that it had been hard to go ahead in aviation because there were no orders. Their first order was for 750 planes on December 8, 1941.

"You can't go mass production on such a basis," he observed, and temporary tooling had to be adopted. Orders dribbled in after that, but in not sufficient quantity to change tools. Tooling was a big problem, in his opinion, because the aircraft industry has to have its own brand of tool designers.

He said they didn't know the ceiling of the P-47 nor its level speed, which has been given at more than 400 miles per hour. There are two kinds of speed, he stated, one measured in relation to the ground, and the other described as "indicated air speed," which takes account of the pressure and instrument recordings at high altitudes where the air is thin.

The former Ithacan told one story about secrecy of operations. It seems that the firm was asked to build a new plant in the interior of the country, far away from the existing plant at Farmingdale, Long Island. Not a word was to be breathed about the site of the proposed construction. Only four persons in the corporation knew of the plans and location. Yet, only a short time after the "secret" meeting, they started to get scores of applications for employment in the "Evansville, Indiana, plant." Apparently, he concluded, some folks must have been taking care of their constituents.

Alfred Marchev

Marchev declared that he was probably not telling any military secrets in saying that more planes are lost in landing, because of difficult conditions, than in actual combat. And in a further statement on mass production, he said "You can't build planes like automobiles. The designs are not frozen."

He received an ovation at the conclusion of his talk and was almost mobbed by the student body who climbed over seats and tables for a limited supply of pictures of the P-47 which he announced they could have "first come, first served."

Sigma Xi Lecturer

PROF. Peter Debye, chairman of the Chemistry Department, has recently been named a Sigma Xi national lecturer for 1943. He will speak to gatherings at several universities throughout the nation. Prof. Debye will discuss the use of magnetic cooling in approaching absolute zero, and why science cannot reach the absolute zero.

Absolute zero is approached by liquefying helium gas. Helium has an extremely low liquefying temperature due to the small forces of attraction among the molecules. It is impossible to reach absolute zero (-273° C) since the temperature decreases toward absolute zero by logarithmic progression. That is, a decrease from .01° to .001° is a factor of ten. Hence absolute zero can never be reached.

The closest approach to absolute zero has been brought about by cooling a paramagnetic salt by means of liquid helium to about 1° Absolute, the temperature of liquid helium. Then the salt is placed in a Dewar flask surrounded by several airtight chambers. The innermost of these contains a small amount of helium gas, the next is filled with liquid helium, the next is evacuated and the next is filled with liquid hydrogen, which has a higher temperature than liquid helium. By employing other materials in this way, the gradual transition from the temperature of the liquid helium to room temperature may be effected.

The entire system is placed within the field of a strong electromagnet. The temperature of the paramagnetic salt approaches 1° Absolute because of its proximity to the liquid helium.

The gaseous helium in the intermediate tube condenses, thus isolating the paramagnetic salt. The action of the magnet aligns the molecules of the iron salt in an orderly fashion. Then the electromagnet is shut down. This causes the molecules of the salt to do magnetic work. Since the salt is isolated, it can do work only at the expense of its internal energy. Consequently, the temperature of the salt falls to .007° Absolute, which is the closest to absolute zero yet reached.

(*Continued on page 28*)

ALUMNI NEWS

Frank W. Pierce, M.E. '16

Frank W. Pierce, ME '16, was recently elected a director of the Standard Oil Company of New Jersey, with which he has been connected since 1927. He joined the Standard Oil Company in 1924, specializing in industrial relations. He has been very successful in this field, and has held a prominent place in many branches of his company.

Upon graduating from Cornell, Mr. Pierce decided to seek his future in South America and joined the Goodyear Tire and Rubber Company, which was planning to build a factory in Brazil. This plan never materialized, and after some time in Venezuela, Panama, and the West Indies, he was recalled to the United States to organize Goodyear's war service department in 1917. It was after this that he became interested in the industrial relations field; in 1921 he made a survey for Goodyear of industrial relations and in 1923 was made personnel manager. It was soon after that that he accepted an invitation to join the Standard Oil Company.

Waterproofing Film

A new type of waterproofing film which can be formed on cloth, paper, and many other materials by exposing them to chemical vapors from a new compound, has been developed in the research laboratories of the General Electric Company by Dr. Winton I. Patnode, who obtained his B.S. in Chemistry from Cornell in 1927 and in 1931 was awarded his Ph.D. Called Dri-Film, one of its more important uses so far is the treatment of ceramic insulators for radio equipment to be used for the armed forces of the United States. It is about nine times more effective than the wax used at present as a water repellant, and its results are permanent.

Dri-Film is a clear liquid composed of various chemicals which vaporize below 100°C. Articles to be treated are exposed, in a closed cabinet, to the vapors for a few minutes. Then they are taken out and, if necessary, exposed to ammonia vapor to neutralize corrosive acids which may collect during treatment. This "raincoat" is so thin that its structure cannot be determined by chemical analysis nor can it be seen under a microscope.

Dr. Winton I. Patnode, '27

In its use in waterproofing ceramic forms, it is advantageous in that it keeps them dry and thus does not reduce the electrical resistance between forms. This is very important in the successful operation of radio equipment and other types of apparatus. Dri-Film increases the surface resistivity and withstands much heat, handling, and cleaning. It is also usable in the laboratory in preventing the formation of a meniscus in measuring cylinders and hydrometers.

Chester Torrence, C.E. '99

Chester Torrance, C.E. '99, M.C.E. '00, died unexpectedly in Havana, Cuba, on December 9, 1942. He lived and worked in Cuba ever since obtaining his degrees here at Cornell. He was one three brothers to graduate from Cornell in Civil Engineering, one being the late William M. Torrance, '95, and the last, Robert S. Torrance, '16.

Chester Torrance was first employed as an engineer on the Sewer System of Havana and later became Chief Engineer of the Water and Sewer Departments of that city. In 1904 he obtained his degree in Civil Engineering from the University of Havana, and from 1907 to 1924 he practiced his profession throughout the island as engineer for a contractor and later as a member of the firm of Torrance and Portal, building pavements and waterworks for several municipalities. He joined the Cuban Society of Engineers in 1910 and took an active part in its work, having served as a director and on several committees.

Grumman Aircraft

More planes were delivered in the last two weeks of November, 1942, by the Grumman Aircraft Engineering Corporation than in the entire year of 1941, according to the annual report released to stockholders by President Leroy R. Grumman, M.E. '16.

Reflecting the output of planes and parts in 1942, gross sales were about 6 and a half times that of 1941, sixteen times that of 1940, and thirty-two times that of 1939, he said.

Design and production of planes for war purposes constituted in 1942 the total volume of business

(*Continued on page* 21)

CORNELL SOCIETY of ENGINEERS

107 EAST 48TH STREET NEW YORK, N. Y.

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

President's Message

Fellow Engineers:

In two previous "Messages" I have discussed the Alumni Placement Bureau. In one I gave an outline of the organization, how it functions and what results had been accomplished. In the March issue I reported that the Alumni Association's President had appointed a Committee, of which your President was a member, to investigate the Placement Bureau and if satisfied that its work should continue not only during the war period but thereafter, to make definite recommendations to the Association as to how this work should be carried on, what funds would be needed and whether it should be a function of the Association or University.

This Committee submitted its report at a recent meeting of the Board of Directors of the Alumni Association and it was referred to the University Trustees for consideration.

The Committee's thoughts on the needs of Placement work are clearly expressed in the opening paragraphs of that report and I quote:

"Your Committee feels that Placement Service is not only an appropriate but a thoroughly desirable function of the University.

"The work of the Placement Service is much broader than the word "Placement" indicates. It not only helps Alumni get jobs, but more important, it helps many to determine in what fields to utilize their talents. This is of broad significance in 1943, when perhaps ten million persons in the United States will have to make radical changes in the nature of their occupations. Our Placement Service is one of the few places where Alumni can go to get constructive help in this direction.

"After graduation, the University rightfully looks to its Alumni for financial assistance. Placement is the one service that the University can give to most of its Alumni. There are relatively few who do not need such service at some time in their lives. Many of course do not use it because it is not accessible, or because they do not appreciate the scope of the service or do not understand how it can help them. There is genuine need of publicizing this work to our Alumni. The Placement Service has done much to cement the relations between the Alumni and the University; it can do increasingly more.


George N. Brown '08

The Placement Service personnel is constructively busy today. In the post-war period its services will be even more essential when perhaps one-third of those who work will have to re-orient their thinking to new types of work, and when the need for actual jobs may be acute."

During this war year your Officers and Executive Committee have carried on the work of the Society as best they could under the circumstances. Some men have left for military services; fewer meetings have been scheduled both in New York and the Regional Groups than last year but the attendance at those meetings which were held has been good; the finances of the Society are in excellent shape and the membership is at an all-time high.

Much credit for this showing is due the chairmen of the various standing committees, to our efficient Secretary-Treasurer, Paul O. Reyneau '13 and to the members of the Executive Committee. This Committee is made up of the officers whose names appear at the top of this page, the three recent Past Presidents, C. Reeve Vanneman '03, John P. Syme '26 and Willis H. Carrier '01 and the chairmen of the standing committees as follows:

Regional Sections, Prof. J. R. Bangs '19; Membership, Wilton Bentley '98; Awards, Herbert B. Reynolds '12; Alumni Representative, Walker L. Cisler '21; Publications, G. T. Minasian '18 and Meetings, Bernard A. Savage '26. Also on this Executive Committee are two representatives from each of the four Schools comprising the College of Engineering as follows: Electrical Engineers, Wilton Bentley '98 and G. T. Minasian '18; Civil Engineering, Lawrence S. Waterbury '19 and Edward B. Kirby '25; Mechanical Engineering, William Littlewood '20 and Malcolm H. Tuttle '18; Chemical Engineering, Henry R. Gundlach '11 and Karl J. Nelson '39.

(*Continued on page* 24)

"Will"

PROMINENT

Wilmer L. Kranich, ChemE

ONE night each week an automobile pulls out of Ithaca, across the highway bound for Corning, New York, and for the Northside High School, in particular. Among its passengers is Mr. Wilmer Leroy Kranich, instructor of Chemical Engineering. Mr. Kranich joins a delegation of several Cornell professors who weekly instruct industrial employees of the Corning area in conjunction with the government's Engineering, Science, and Management War Training Program. Conducted very much in the manner of similar classes at Cornell, those at Corning serve as "refresher" courses for men in industry eager to extend their knowledge for the best interest of the war effort. Keeping engineers geared to the latest developments in scientific progress, Mr. Kranich has taught classes in Chemical Engineering Unit Operations and in Absorption and Extraction. His present assignment is a course in Industrial Chemical Calculations, designed to study the applications of principles of chemistry and physics to industrial chemical problems.

The services of Mr. Kranich and men like him are critically needed by Corning Glass and scores of other top industrial concerns hard pressed to keep pace with the extensive organic changes which are sweeping through American manufacture, a result of war demands. Mr. Kranich and an army of others, under Government auspices, are bringing education to industry, in the attempt to give manufacturing concerns the additional tools of engineering knowledge which will stimulate the fullest use of elementary resources.

Mr. Kranich's direct contribution to the war does not end here. Under government sponsorship he is working for the nation's Rubber Reserve Corporation, together with five other Cornell graduates and undergraduates, to obtain engineering data relating to the manufacture of synthetic rubber. The RRC sponsors a body of scientists working in plants and colleges, amassing data that will eventually enable America to free itself from dependence upon natural rubber stockpiles. Mr. Kranich is reticent to discuss his work more explicitly in view of desirable secrecy.

Mr. Kranich, born in Philadelphia, received his B.S. in Chem.E. at the University of Pennsylvania. There he was elected to Alpha Chi Sigma, Tau Beta Pi, Phi Kappa Phi, and Pi Mu Epsilon, obtaining also the editorship of the "Pennsylvania Triangle", engineering publication. A McMullen fellowship brought him to Cornell after college graduation. Active at Penn in choral singing, Mr. Kranich continues that hobby at Cornell in the Sage Chapel choir. Past summers have found him studying catalytic cracking in gasoline manufacture at the Atlantic Refining Company and operating gasoline distillation stills at Gulf. Summers have not always been steeped in oil. Last year he undertook research in film properties at Eastman Kodak.

Companion to his work on rubber, which he will use toward his doctor's thesis, Mr. Kranich teaches Chemical Engineering Instrumentation. This course pursues the basic principles of process control which underlie the measurement and regulation of pressure, temperature, fluid flow, liquid level, pH, humidity, and chemical composition. He also assisted in the work at Olin Hall's Unit Operations Laboratory.

Today Mr. Kranich stands at the threshold of a career promising a wide scope of service to scientific advancement, in the chemical industries especially.

Robert E. Hutton, EE

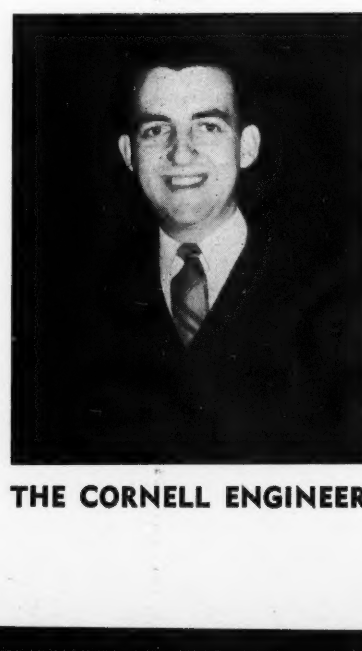
BOB Hutton is listed in the *Directory of the University* as Hutton, Robert Earle, '43, Electrical Engineering. From it we also glean his address, phone number, and the fact that he hails from Canandaigua, New York. That's about all you can get from the directory, but there's more to the story than that.

Bob is a graduate of Canandaigua Academy where he had quite a distinguished career. Music has always been his hobby, and he's pretty good at it. At Canandaigua he played in the school band which won the National Band Championship as well as the New York State Award. He played in the orchestra, and was solo clarinetist in the National Championship Clarinet Quartet that won the title in 1938.

He is very specific about his reasons for coming to Cornell. Aside from music, his other hobby is electricity. He considered several other schools, but decided on Cornell because he wanted to get something more out of college than just a narrow technical education. He realized Cornell was ideal because, in addition to being tops as an engineering school, it would give him the opportunity for a well rounded education. He wasn't kidding either, as a glance at the rec-

(*Continued on page* 26)

"Bob"



ENGINEERS

Richard M. Junge, ME

IT HAS often been the rule that the most brilliant of students are the least brilliant in athletics. There are, however, exceptions to that rule, not the least outstanding being Ridgewood, New Jersey's Dick Junge. (And just to be sure there's no misunderstanding about that last name, it's pronounced Young). A combination of better than average grades with active sports participation has been the rule rather than the exception in this case.

Born in Ridgewood, Dick has lived in that residential town all his life. Active in high school activities, he was elected president of his senior class and also participated in soccer and track, of which we shall hear more later. Following his graduation from high school cum laude, he entered Cornell in the fall of 1939, to take up the study of mechanical engineering. His efforts his freshman year were highly successful and as a consequence, he was awarded a McMullen scholarship when he returned to college in the fall of 1940. That was after a summer spent in the Patterson works of the Wright Aeronautical Company. That experience was of real import to him in as much as he is specializing in aeronautical engineering here at Cornell.

Dick joined Sigma Chi when he returned to college that fall and with that began his varied but steady climb to the top in college life. The spring of that year he went out for track—the pole vault—and was only moderately successful. His efforts were but mildly rewarded in athletics that spring, but he succeeded in making the Dean's List for the fourth straight term before calling it quits for a summer of outdoor work as a carpenter in his home town of Ridgewood. He was not tied down as much that summer as he had been the previous one and was able to get out to New London fairly often to sail on Long Island Sound in a 26 foot craft. A pet hobby of his, sailing is a bit difficult for him to pursue, owing to the fact that the waters of Lake Cayuga are not too satisfactory for the sport.

His junior year laid the ground work for recognitions that were to come late in his junior year and in the first part of his senior year. The spring of that year found him out for track again, eager to win a coveted varsity letter in track. Under the unceasing tutelage of veteran coach "Jack" Moakley, Dick succeeded in scaling the bar at 12 feet 6 inches. That proved to be his best vault and he won his varsity letter. Along about the same time, he was elected to the coveted Tau Beta Pi; to Atmos; and to Scabbard and Blade, military department honorary society. And just by way of winding up the year in proper fashion, he completed his sixth straight term on the Dean's List. Then, seeking a variety of experience, he spent a summer of hard and hot work in a machine shop in near-by Patterson as a grinder,—quite a difference from the hills of Vermont where he has been in the habit of skiing during his winter and spring vacations now and then.

With the war already nine months gone, the aspect of his R.O.T.C. training took on added significance in the fall of 1942 and Dick began to plug away at his advanced drill ordnance course with

(*Continued on page 26*)

"Dick"

"Lou"

Louis G. Helmick, Jr., AE

IT'S FALL. The football season is in full swing and out on the gridiron we see the Big Red Team's Lou Helmick pulling for the Cornell cause. We have all heard of Lou's feats out in Schoellkopf, but how many of us know him beyond that?

Advised by his prep school and the Pittsburgh Alumni association, Lou came to Cornell four years ago as an AEME. He already had a background in engineering, as his Dad builds mine cars and tipple equipment back in West Virginia. Lou has learned quite a bit from his Dad's business, at which he has worked some six summers. As he became acquainted with the trade, Lou got experience in drafting, machine shop and foundry work, and arc welding. Last summer, however, he decided to get a job elsewhere, so he worked at the Morgantown Ordnance works, a duPont plant started before the War for the manufacture of nylon, but which now makes ammonia for the production of TNT. His job was to check mechanical installations.

At Cornell, Lou has compiled quite a list of accomplishments besides being a varsity football player. He has been on the Student Council for three years and has been its vice-president and treasurer. He is also a member of Sphinx Head; Tau Beta Pi, honorary engineering society; Red Key; Kappa Tau Chi; Scabbard and Blade; Majura; the Junior Blazer Committee; the Sophomore Committee; and the

(*Continued on page 26*)

"Loose Juice"

By BOB GARMEZY and ED RICH

The Plight of the Humble B.E.E.
or
Have a Cigar, Professor Strong

There's a course which must be taken by electrical engineers,
And it's taught by a guy named Strong;
And the homework that he gives you would most drive a man to tears,
Because it's so gosh darn long!

Oh, we work with phi and beta, and magnetomotive forces,
In a manner which seems most vague.
Though they tell us it's the basis for our subsequential courses
Still, to us, it's a constant plague!

Now the guy from whom we take this is an author on the side,
And you ought to see the text he writes!
It's a much worked-over volume which he speaks of with great pride,
And there isn't a phase he slights!

It starts out with basic problems and with fundamental theory,
But its pause there is quite brief.
Ere first thought is comprehended, of the second we are weary,
And the third comes on without relief!

"State the physical situation which give rise to the expression,
'F equals B L I.' "
"What's your concept of 'flux-cutting', and explain without disgression",
"Is mu sub-zero fixed, and why?"

"Circular mils" and "ohms per inch cube", "lines per square inch", "ampere-turn",
What a mess this gets to be!
"Electrostatics", "dieletrics"—all this stuff we've got to learn,
As a candidate for B.E.E.

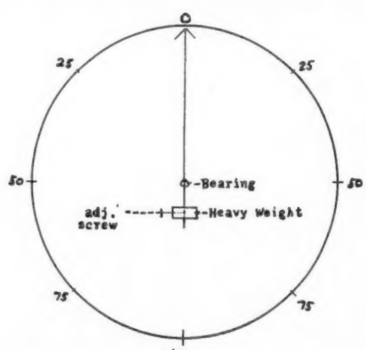
Teaching us is quite a problem: (as is obvious by now),
One at which they work with zest;
Smith suceeds with explanations; Strong great wisdom does endow,
But his puns should be suppressed!!

Though of "concepts" we are tired; of "expounding" we are weary,
And it isn't all over yet,
We're contented in our misery: half awake, eyes always bleary;
Our choice of course we don't regret!

Yes, there's a course which must be taken by electrical engineers,
And we're glad it's almost done,
For, although it's been quite interesting throughout the entire year,
Writing this has been more fun!

—*Milton Stolaroff and Bud Thompson*

New Prelim Grader Developed



To Operate:

1—Concentrate on the name of the student whose paper is to be marked for 10 minutes (or seconds, as desired.)
2—Adjust pointer weight.
3—Place finger on pointer(referred to as fickle finger of fate).
4—Rotate pointer in either direction depending on whether professor is left or right handed or both. (Induction motor supplied for those professors who are neither—$10 extra).
5—Read pointer from any desired position or direction.

Theory:

1—Pointer bearing is lubricated with gritty oil.
2—Weight and weight adjustment is provided so that professor can have sporting chance to bust student.
3—Operation (5) gives any degree of accuracy required, since the pointer is five inches from the dial board.

* * *

When a diplomat says, "Yes," he means, "Maybe."
When he says, "Maybe," he means, "No."
If he says, "No," he isn't a diplomat.
When a lady says, "No," she means, "Maybe."
When she says, "Maybe," she means, "Yes."
If she says, "Yes," she isn't a lady.

* * *

FAMOUS LAST WORDS

1. Let's have one more short one.
2. These wires are dead.
3. Tomorrow's prelim will be easy; let's go to the movies.
4. My classification is 1A.
5. After all, they can't bust the whole senior class.

* * *

A ChemE freshman, asked to define a bolt and nut, wrote the following answer:

"A bolt is a thing like a stick of hard metal such as iron with a square bunch on one end and a lot of scratching wound around the other end. A nut is similar to the bolt only just the opposite, being a hole in a little chunk of iron sawed off short, with wrinkles around the inside of the hole."

* * *

Mech. Lab. is like knocking your head against the wall—it feels so good when you quit.

Grumman Aircraft

(*Continued from page* 16)

of the company, Mr. Grumman pointed out. "Wildcat" fighters and "Avenger" torpedo planes were delivered in quantity throughout the year and "have contributed in no small measure to our naval air strength."

One of the important design contributions developed by the company is the new type folding wing that doubles fleet aerial protection in one step. It permits an increase in carrier fighter capacity of approximately 100 per cent and in carrier torpedo-bomber capacity of more than 50 per cent. The value of the smaller converted type of aircraft carrier has been tremendously increased as a result of this development, it was pointed out.

J. H. Lynah, M.E. '41

JOHN Heyward Lynah, has been promoted to the rank of major at the Field Artillery Replacement Training Center of Fort Sill, Okla. Major Lynah was called to active duty as a second lieutenant July 11, 1941. He was promoted to first lieutenant February 23, 1942, and to captain August 28, 1942. The major, a Delta Phi from Cornell University, was graduated from Cornell with a degree in mechanical engineering in 1941. He was associated with the Savannah Sugar Refining Co. when called to active duty.

He is assigned to duty at the Replacement Center S-4 office, where he is in charge of all Center motor maintenance and motor maintenance instruction.

Tavares Returns

VISITING the Cornell campus for the first time after a lapse of 25 years, John T. Tavares, who is in business in Santo Domingo, was amazed by the number of new buildings that have arisen. Mr. Tavares, who received his degree in civil engineering from Cornell in 1918, was particularly impressed with Olin Hall, Willard Straight Hall, Martha van Rensselaer Hall, Myron Taylor Hall, Baker Lab, Barton Hall, and the new dormitory areas. He also made arrangements, through the Secretary's office, to get a copy of his 1918 diploma, for the original was virtually torn to shreds when his home was leveled by a hurricane in the early 1930's.

J. W. Parker, '08

It was announced recently that James W. Parker, '08, has been elected General Manager of The Detroit Edison Company. At the time of his election Mr. Parker was serving as Vice President of the Company.

Mr. Parker, for ten years an Alumni Trustee of the University, is Past President of The American Society of Mechanical Engineers and of the Engineering Society of Detroit. He has been a frequent visitor to Ithaca and has a number of times addressed the senior class of the School of Mechanical Engineering.

(*Continued on page* 32)

Plastics

(*Continued from page 7*)

The next specimen shows a steel ball free to roll around inside the hollow cylinder which is molded around the ball in one piece. The hollow ball shown in the upper right-hand corner has an interesting feature which unfortunately does not show in the photograph. On the inside, in raised figures, is the date, November 27, 1929. Further evidence of the possibilities of this method of molding is brought out in the other pieces shown in the illustration.

While it is true that these parts might be classed as "trick pieces," and not commercial applications, nevertheless the information and experience gained through producing them has proved to be invaluable in solving some of the more difficult problems presented by industry.

For instance, in the electric eye, a very important feature is the glass window in the front of the piece. From the experimental work carried on with the glass ribs in the hollow cylinders, it was learned that glass could be successfully incorporated into a molded object when it was produced by the transfer method of molding.

Again, when a manfacturer of electrical instruments wished to insulate a complicated and delicate copper insert, the knowledge obtained from experimenting with copper foil proved to be very valuable. The insert and molded piece are shown in Figure 1 at the right. The copper from which this insert is constructed is .010 in. in thickness. Before going to transfer molding, attempts were made to cast insulating material around this insert assembly, without success. After its adoption, the job was put into production, using a general-purpose phenolic molding material.

The hollow resistor housing is another practical application of the experience gained by means of these early experiments. Here a delicate coil form wound with hair-like wire is completely encased in a molded housing. This assembly would undoubtedly have been crushed by the compression method of molding.

Automatic Molding

Full automatic molding of plastic materials has been the dream of a great many individuals for some time. The first successful automatic molding machine was developed in Europe. It was designed for the injection molding of thermoplastic materials. In this process, like transfer molding, the mold is closed empty. The thermoplastic material is made soft or plastic in a separate heating chamber and then under pressure it is injected into a relatively cool mold through an orifice where it takes on the shape of the mold and again reverts to its solid condition.

A good many of these units were imported and set to work in the molding plants of this country. The American press manufactures, however, were quick to see the handwriting on the wall, and now a number of them are manufacturing such machines. Recently, several fully automatic presses designed to

(*Continued on page 24*)

Plastics

(*Continued from page* 22)

handle phenolic and urea materials have been developed in this country.

One of the first fully automatic molding presses to make its appearance for the fabrication of thermosetting materials operates on a rotary principle (see Fig. 2). Twenty or more individual hydraulic rams are mounted on a revolving table. As rotation takes place around a central pressure column, pressure is first applied, thus closing the mold. The pressure is maintained over the greater portion of the circle and then it is reversed to open the mold. The mold charge, in the form of loose powder, is fed directly into the cavities by a suitable loading mechanism. The parts are also removed automatically.

The conventional hydraulic press has been made fully automatic by doing all the ordinary operations by mechanical means. These include preforming and preheating as well as tumbling. This type of automatic press appears to be the only one to date that performs the complete operation from drum of molding material to shipping carton. To be sure, they have not as yet reached a state of perfection, but they are far enough advanced to be turning out parts in regular production. Another recent development which will undoubtedly have far-reaching effects in the technique of plastic molding was announced by the Bakelite Corporation in March of this year. It is known as Heatronic Molding and employs the use of high-frequency current in an electrostatic field as the source of heat required in the process of molding the thermosetting type of materials. By means of Heatronic Molding, the length of time required to mold the pieces can be greatly reduced, and also parts can be molded at pressures lower than those required by conventional methods of molding. Through a combination of transfer, heatronic, and automatic molding, many jobs heretofore considered impractical, if not impossible, now seem to be accomplished facts. Thus a sign once seen in the blacksmith's shop might well apply here . . . *The difficult jobs are done right away; the impossible ones take a little longer.*

President's Message

(*Continued from page* 17)

Nominations

The Nominating Committee has nominated the following for election to office for the coming year:

Pres. James Lynah '05
Exec. Vice-Pres. B. A. Savage '26
Secy Treas. P. O. Reyneau '13
Rec. Secy. W. Reck '14

Elections will take place at the annual meeting May 5, 1943.

As this is my last letter to the members of the Society as President, I wish to take this opportunity to express my deep appreciation of the honor which was conferred on me and the opportunity which was given me to be of service to the Society.

Any degree of success which this administration may have had was due entirely to the unselfish contribution of time and effort on the part of the other officers and members of the Executive Committee.

Very truly yours,

G. N. BROWN '08
President.

Dick Junge

(*Continued from page* 19)

the result that at the recent promotions he was made a cadet captain. His return to college last fall also found him in for some unexpected, but hoped for, rewards for his efforts. He was made house president of his fraternity, was elected to Quill and Dagger, and was appointed an assistant in the materials department in the College of Engineering. Along with all this, he was elected to the presidency of Spiked Shoe, distinguished track honorary society, and was elected to Phi Kappa Phi, national scientific society. Continuing his efforts in track, he was one of five Cornell track men who succeeded in staging a sensational upset in the winter indoor IC4A track meet in New York City, when they walked off with third place. In that meet, Dick tied for third in the pole vault with a Syracuse man. That brings him up to the present time, and he is still going strong—aiming for eight straight terms on the Dean's List.

Bob Hutton

(*Continued from page* 18)

ord will show. He has kept up with his interest in music, playing in the Varsity Band for 3 years, and acting as solo clarinetist in the Cornell University Symphony. He is a member of the Clef Club, the Band Honorary Society. He revealed that it is becoming difficult to keep up with the music, what with the prelims they hand out in Dr. Lewis's stronghold.

In the E. E. School Bob has made quite a name for himself. He is President of Eta Kappa Nu, the honory society in Electrical Engineering; Vice Chairman of the A. I. E. E., and a member of the Delta Club, E. E. social society. In his last year of college he has been elected President of his fraternity, Alpha Sigma Phi. Memberships on the Freshman Advisory Committee and in Alpha Phi Omega, National Service Fraternity, round out his major activities at Cornell.

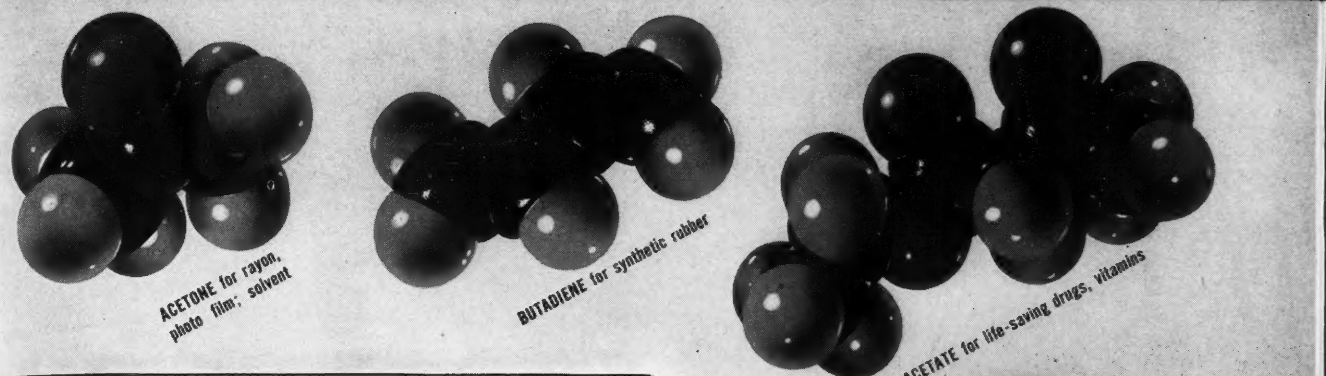
His future seems to be pretty clear, up until June anyhow. He is graduating in June as a power major and has a commission as an Ensign in the Navy. After that he says anybody's guess is as good as his as to what will happen.

Lou Helmick

(*Continued from page* 19)

Cayuga Blasters. This year he is president of his fraternity, Sigma Alpha Epsilon. Because of his scholastic merits, he had a McMullen scholarship for three years and last year he received an Eidlitz scholarship.

Lou expects to go straight to Aberdeen after graduation as he is in the advanced ROTC (Ordnance). After the war is over Lou hopes to get into the sales line of engineering, or perhaps into production.



Molecular Keys To A New World

VAST NEW SOURCES of raw materials . . . the equivalent of those which might be found in a great new continent . . . opened to America when CARBIDE AND CARBON CHEMICALS CORPORATION, a Unit of UCC, started building synthetic chemicals from water, salt, air, and hydrocarbons.

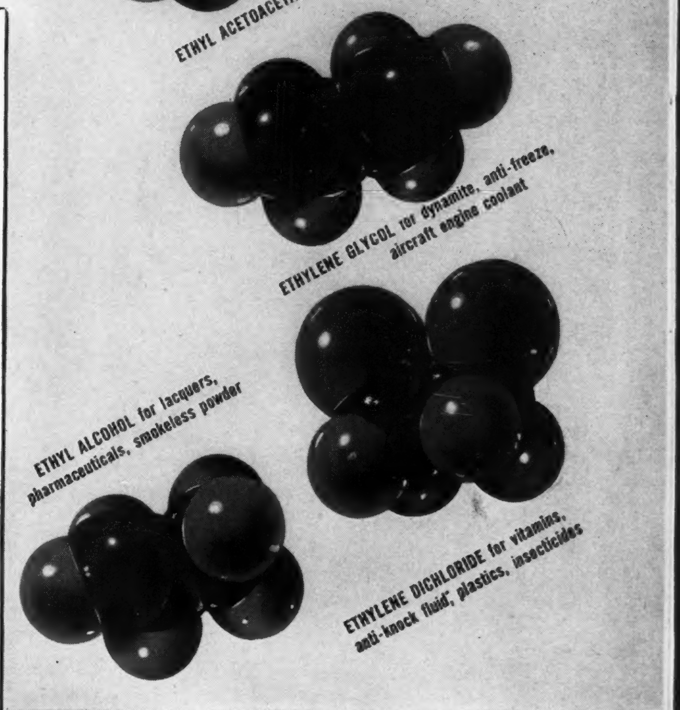
These chemicals are usually water-white liquids, although some are gases or solids. Basically, they are compounds of carbon and hydrogen—united with oxygen or with chlorine to build up an endless series of chemicals. The models of those molecules of chemicals shown here are many millions of times actual size.

These chemicals are the raw materials for fabulous plastics . . . amazing textile fibers . . . life-saving drugs . . . vitamins by the carload . . . synthetic rubber . . . more things and better things than were possible before their existence.

Since these chemical wonders are obtained from abundant domestic sources, their use has contributed materially to the nation's self-sufficiency. Through research, American ingenuity, and patient development, scarce natural products have been duplicated or improved upon. Great new industries and great new materials that contribute to the nation's strength have come into being. And America has become a leader in a field as native as its own soil.

Broadly speaking, the uses of many of the synthetic organic chemicals developed by CARBIDE AND CARBON CHEMICALS CORPORATION are just beginning. The already established uses are indicative of their vast future values to mankind.

BUY UNITED STATES WAR BONDS AND STAMPS



BETTER MEDICINES! Amazing medicines like the sulfa drugs, synthetic vitamins, powerful insect repellents, and anti-malarial drugs depend upon synthetic organic chemistry.

COLD PROOF! Coolant for liquid-cooled aircraft engines and base for anti-freeze in military cars and trucks is ethylene glycol, an important synthetic chemical.

MAGIC PLASTICS! Wonderful plastics that look like glass, stretch like rubber, and which are proof against water, sunlight, oils, and many chemicals are made from VINYLITE synthetic resins.

MAN-MADE! All types of synthetic rubber require synthetic organic chemicals for their manufacture. Here's hope for tires for you in the future.

UNION CARBIDE AND CARBON CORPORATION

30 East 42nd Street UCC New York, N.Y.

Principal Products and Units in the United States

ALLOYS AND METALS
Electro Metallurgical Company
Haynes Stellite Company
United States Vanadium Corporation

CHEMICALS
Carbide and Carbon Chemicals Corporation

ELECTRODES, CARBONS AND BATTERIES
National Carbon Company, Inc.

INDUSTRIAL GASES AND CARBIDE
The Linde Air Products Company
The Oxweld Railroad Service Company
The Prest-O-Lite Company, Inc.

PLASTICS
Bakelite Corporation
Plastics Division of Carbide and Carbon Chemicals Corporation

Sigma Xi

(*Continued from page* 15)

This method of approaching absolute zero was originated by Prof. Debye. The actual process was carried through by Prof. Simon of Oxford University working in Paris, where the special equipment required was available.

At the present time, Prof. Debye is doing important war work for the government.

"The Cadetter"

FIRST issue of "The Cadetter," a mimeographed monthly published by engineering cadettes of the Curtiss-Wright Corporation, contains news and cartoons of activities throughout the country where the program is in effect.

An anonymous contribution from one of the trainees at Cornell called "Harriett with the Light Blue Jeans," says that Cornell engineers became used to the idea of women as engineers "before we arrived," so heckling from that source was not what it might have been.

"It isn't that a man's vanity is injured by the thought that a woman could do his work; he sincerely believes that the thing is impossible. Classic examples like Curie and Madame Chiang Kai-shek are only scientific mistakes, like Siamese twins and dictators. Women, they chuckle affectionately, mean well, but they just don't have any sense.

"But those of us who really hope to help the war effort will get a lot of personal satisfaction out of watching a plane fly whose tail we blueprinted, even if it doesn't prove a thing. After our first week of classes, it was impressed clearly on our minds by our professors that they were going to make engineers of us or die in the attempt."

Another item says a large number of the girls are musicians. They play piano, clarinet, flute, violin, viola, and other instruments.

One writer says that without exception they think Cornell has the most beautiful campus they have ever seen . . . The buildings, which are old, reek with atmosphere, and are scattered over an area large enough to hold a city.

Wartime Engineering

(*Continued from page* 9)

be interchangeable with those hoists already in use.

Getting A New Flame Cutter

In the line of obtaining new equipment, we were given most effective assistance. A salesman for a flame cutter did such a good job that we obtained a government order to seize one that he was going to deliver to another shop. The owner of that shop hasn't been what you would call real friendly ever since. However, the first time we put it to use it solved a production problem that had had us guessing for a month or more.

We were in the midst of getting out our shop drawings when the recruits from Ithaca began to arrive. Jack Baer wanted to work on drafting and design. The rest did the same thing whether they liked it or not until we began to catch up. However we did transfer them to the shop as soon as possible.

As I recall, the following are some of the jobs to which they were assigned: Tearing out and rebuilding partitions, assembling and installing fluorescent lights, repairing the roof, installing cleaning tanks, spray-painting equipment, setting up machine tools and the monitor crane and crane way. They also ran electrical conduits, water and compressed air lines, not to mention cleaning welds and drilling holes by the thousands in various gusset plate assemblies. This last has now been mostly superceded by flame cutting the larger ones and punching the smaller.

Eventually Harold Sipperly became a punch and shear operator. Jack Thompson, as a student in chemistry, was assigned to getting the acid bath cleaning tanks into operation. The Thompson brothers built a temporary storage rack out of odds and ends of lumber. It served the purpose intended but it was obvious that the design was not taken from a C.E. handbook. Jack Baer worked out a jig for our band saw that put a complicated sawing operation on a production basis. Eventually he took over making load tests on the hoist for various Air Corps representatives and ended up as our shipping crate designer.

Clyde Loughridge started us off on inspection, inspection gauges, and production control. In connection with this last he helped in the development of a production flow board upon which we depend, in keeping the various parts coming up to the final assembly in quantities as needed instead of just hoping for the best. Jack Barker, in spite of the handicap of an Arts course, became one of our experts in assembling and installing fluorescent lights.

In the original plan we had intended to place the boys in the various steps in production, to help break in a permanent shop organization. Due to the long delay in getting all of the materials required, it was the end of summer before we made our first shipment. By this time they were due back in Ithaca. Meanwhile we had gone as far as possible in working up whatever did come in. As a result the shop was more of a warehouse than a production plant.

Additional Contract Received

Along the middle of summer,

(*Continued from page* 32)

Wartime Engineering

Continued from page 30)

when it still seemed only remotely possible that we would ever get all of the parts necessary to fill the first order, I found Ben at his desk in an acute state of nervous collapse. After taking the necessary steps to revive him, I learned that the Air Corps had just called up long distance from Dayton to ask when we could start on an additional order for several thousand more units. Eventually by agreeing to supply all of the engineering experience as well as the drawings, we persuaded them to place half of the order elsewhere.

We are well along on this second order, and produce two or three times as many per day with the same equipment as we did at first. This is partly due to better organization, but a great deal is due to being allowed to deviate from the original design where relatively small changes stepped up the rate of production. Our tests show a sixty-five percent increase in capacity with around a five percent reduction in weight. According to calculation it can't be done; so we have the boys set one up every now and then and apply the load to see if it is still so. Basically it is the original design and my hat is off to those air field mechanics who first worked it out.

Incidentally this is the second war in which I have worked on industrial engineering. As far as my personal experience is concerned, there is a vast difference. In the first, we were held rigidly to whatever design accompanied the order, regardless of its effect on production. As a result many deliveries never arrived at the front until the war was over. This time if a change will speed up production, save scarce material, or improve performance, we have almost invariably been granted the deviation. From what I have read of other production records, following redesigns, I believe this co-operation between the engineers of the armed forces with those in production is one of the chief reasons for the remarkable showing made in this war in equipping our armed forces in so short a time.

Navy "E"

(Continued from page 21)

ANOTHER industrial firm in which a Cornellian holds a top administrative position has received a production award. The United Carr Fastener Corporation of Cambridge, Mass., has received the Army-Navy "E" for excellence in the production of fasteners used extensively on airplanes, parachutes, tanks, cars, clothing for the armed forces, and other items of equipment. Alumni Trustee George H. Rockwell, M.E. '13, is an executive of the firm.

Correction

In the April, 1943, issue of the CORNELL ENGINEER appeared an article announcing that Lewis A. Anderson, C.E. '40, had been killed in action. Since that time the War Department has corrected this earlier announcement with the issue of a statement that Mr. Anderson is still alive.

STRESS and STRAIN...

College chum: "What did you do this summer?"
College pal: "Worked in my father's office. And you?"
College chum: "Oh, nothing either."

* * *

"Oh dear, I miss you so much," she said as she raised the revolver and fired again.

* * *

And then there was the moran who moved to the city because he heard the country was at war.

Beneath the sod lies Mannie;
They put him there today.
He lived the life of Riley
While Riley was away.

* * *

Missionary: "I suppose tonight's banquet will be quite a thrilling feast."
Cannibal King: "You have no idea how you'll be stirred."

* * *

"We had a burglar break into our house last night."
"Did he get anything?"
"I'll say he did—my wife thought it was me!"

Courtesy Westinghouse

Reporter: "I've got a perfect news story."
Editor: "How come? Man bite dog?"
Reporter: "No, but a hydrant sprinkled one."

* * *

"Is this a picture of your fiancee?"
"Yes."
"She must be wealthy."

* * *

The Queen Bee is a hardy soul—
She thumbs her nose at birth control;
Which is the reason beyond a doubt;
There are so many sons of bees about.

Have you heard the story of the man who promised his sweetheart that he would always remain faithful to her? One day during his wanderings he came upon a high stone wall. He burned with curiosity to discover what was on the other side so he clambered to the top. From his lofty perch he observed a great number of beautiful damsels gazing wistfully up at him. While deciding whether or not to keep faith with his lover he fell and broke his word.

* * *

Jim: "I proposed to that girl and would have married her had it not been for something she said."
Lou: "What did she say?"
Jim: "No!"

Coed: "I'd like to see the captain of this ship."
Sailor: "He's forward, Miss."
Coed: "That's all right, this is a pleasure trip."

* * *

He: "Only a mother could love a face like that."
She: "I'm about to inherit a fortune."
He: "I'm about to become a mother."

* * *

Elsie: "I'm forgetting men."
Ethel: "So am I. I'm for getting a couple as soon as possible."

* * *

A farmer was phoning a veterinarian. "Say, Doc," he said, "I've got a sick cat. He just lays around licking his paws and doesn't have any appetite. What shall I do for him?"
"Give him a pint of castor oil," said the vet.
Somewhat dubious, the farmer forced the cat to take a pint of castor oil. A couple of days later he met the vet on the street.
"How's your sick calf?" inquired the vet.
"Sick calf! That was a sick cat I had."
"My God, did you give him a pint of castor oil?"
"Sure did."
"Well, what did he do?" asked the vet.
"Last time I seen him," said the farmer, "he was going over the hill with five other cats. Two were digging, two were covering up, and one was scouting for new territory."

* * *

An optimist is a man who does cross-word puzzles with a pen.

* * *

He: "My love cannot be expressed by words."
She: "Come over and tell me about it."

* * *

Employer: "Have you unimpeachable credentials?"
Applicant: "Well sir, if I do say so myself, there's very few men as don't look twice at 'em."

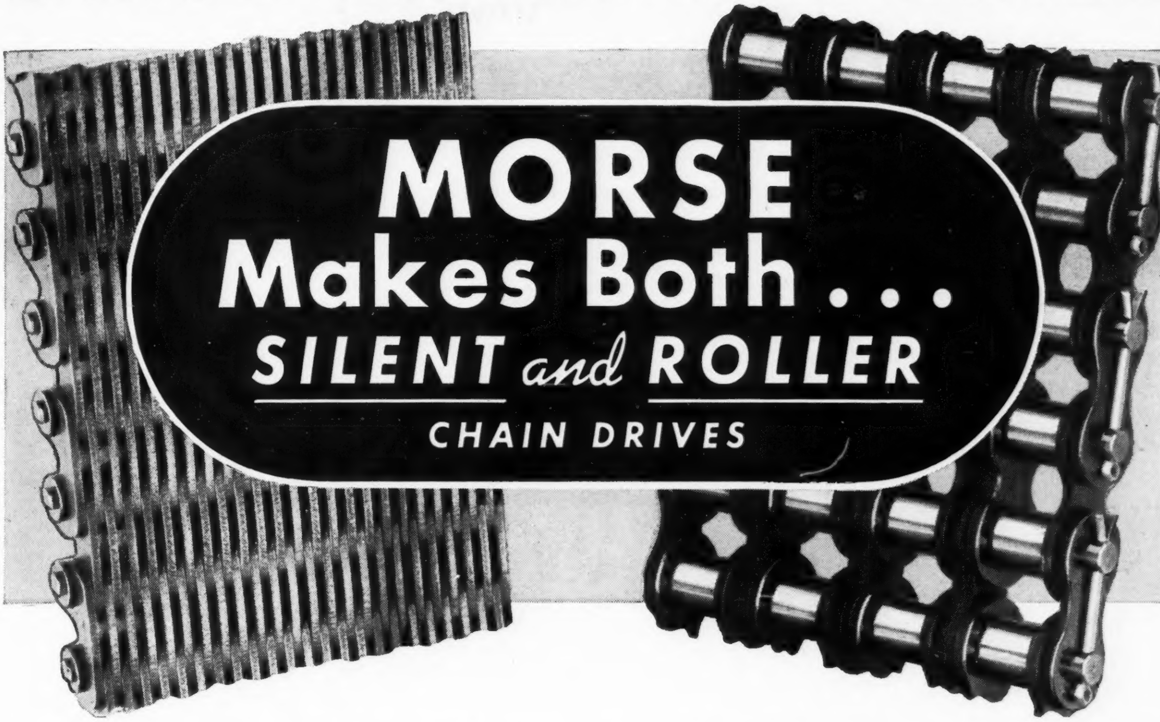
Index to Volume VIII

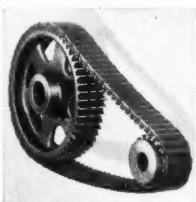
ARTICLES

AUTHORS

PERSONALITIES

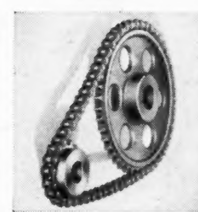
'AN IMPORTANT ADVANTAGE IN PLANNING POWER DRIVES

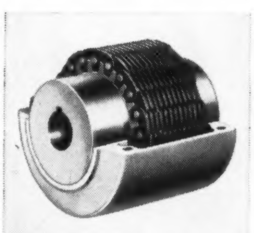


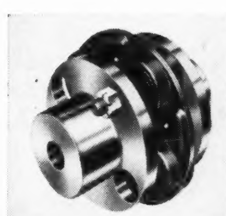


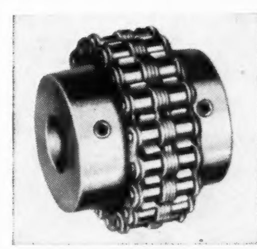
Morse Silent Chain Drives operate at practically 100% efficiency, year after year. Quiet and smooth in operation, they insure maximum machine output. The Morse principle of "Teeth, Not Tension," means no slip—no wasted power. Wide range of chain capacities.

Morse Roller Chain Drives are equipped with effective "oil feed" system in every link. This exclusive design gets oil to the heart of chain. Oil gets in, wear stays out! They last longer, require less maintenance. Interchangeable and available in single and multiple widths.









Morse Silent Chain Couplings compensate for shaft misalignment. This simple and rugged coupling consists of two facing steel sprockets wrapped with Morse Silent Chain—enclosed in a machined split case. Links acting on sprocket teeth form flexing medium. They are easily installed and available in many sizes.

Morse Morflex Couplings contain two steel hub members and a floating center unit assembly to which each hub is separately connected through resilient rubber trunnion blocks. There is no metal on metal movement. Rubber allows for maximum distortion without loss of efficiency. Cuts maintenance cost.

Morse Roller Chain Couplings embody many outstanding features that make for unusual flexibility and long-life. Highly compact, they consist of two facing sprockets wrapped with Morse Roller Chain. Easy to install and align. Wide range of stock and special sizes—covers if desired. Send for coupling data today.

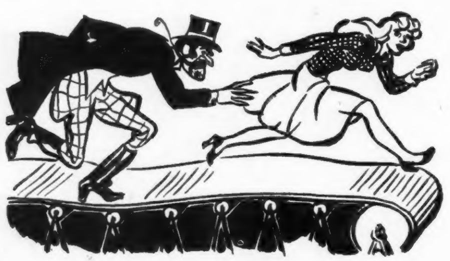
SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

G-E Campus News

RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD

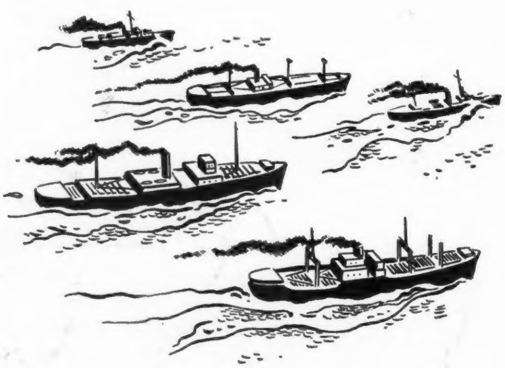


FOILED!

WHEN in a movie "the villain pursues and pursues her," he's not really getting anywhere at all.

To keep the players within camera range while they are constantly on the move—going nowhere—the Metro-Goldwyn-Mayer studios are now using a sound-insulated treadmill, powered by General Electric.

An even motion was required through all the action shots, from a slow walk to a race. Now, in 30 seconds, the treadmill can be accelerated smoothly from zero to full speed in either direction, by means of a G-E motor-generator set.



LEND-LEASE IN REVERSE

USUALLY we think of the United States as the arsenal and machine shop of democracy, but actually the Atlantic is a two-way ocean. And General Electric recently announced that since early in 1942 the Company has been using five giant English metal-working machines in the production of vital ship-propulsion equipment.

The machines were sent from England in separate ships on different dates, to forestall their destruction by German submarines. One of the ships was attacked during the crossing and was damaged but made its American port safely.

The arrival of the machines was really *two* strikes against the Nazis, for had they remained over there they might not now be producing for the United Nations. One of them had been installed in a plant in Sheffield, and another was destined to go there—and that city was later bombed by the Axis.

"PAPER DOLLS"

RIGHT out of the kindergarten is the latest metal-saving technique in General Electric. Many thousands of complexly designed parts are required for intricate electric apparatus—and all must be cut from flat sections of scarce metals.

So, just like patterns for paper dolls, the planners draw the parts to scale on paper, cut them out, and shift them around till they mesh together in a manner very similar to a jigsaw puzzle.

Frequently it is possible to redesign the parts when it is found that slight changes in the length, width, or thickness will allow more parts to be cut from the same layout.

Photographs of this technique may be obtained free by writing Campus News, General Electric Company, Schenectady, N. Y.

Listen to the "Hour of Charm" at 10:00 p. m. EWT, Sundays, on the NBC network, and the G-E news program with Frazier Hunt at 6:00 p. m. EWT, Tuesdays, Thursdays, and Saturdays on the CBS and American (FM) networks.

GENERAL ELECTRIC

953-60-211